

REVIEW OF THE CATCH AT AGE OF THE BAY OF BISCAY BLUEFIN TUNA FISHERY (1950-2000)

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SUMMARY

Based on previously published analytical data, a review is presented of the catch at age (CAA) of the Bay of Biscay bluefin tuna fishery between 1950 and 2000. The period between 1950 and 1965 has the least biometric information on the species in this area, and so substitutions have been made using data from later years, for which abundant information is available. The results confirm that the CAA of the juvenile groups (1-4 years) in the first decade of the historical series (1950s) used in the last bluefin tuna stock assessment in 2014 is considerably underestimated, such that the number of juveniles for the 1950-1962 period used in the assessment is half that of the values obtained in the present study for the Bay of Biscay fishery alone in the same time period. The scenario is even worse if we consider that, according to a recent publication, approximately 2.8 million one year old specimens would have to be added to the figure presented here, which are absent from the CAA of the last stock assessment, caught using purse seine in the Moroccan Atlantic fisheries between 1958-1962.

RÉSUMÉ

Sur la base des données analytiques publiées précédemment, un examen est présenté de la prise par âge (CAA) de la pêcherie de thon rouge opérant entre 1950 et 2000 dans le Golfe de Gascogne. La période courant entre 1950 et 1965 comporte le moins d'information biométrique sur les espèces dans cette zone et c'est pourquoi des substitutions ont été faites en utilisant les données des dernières années, pour lesquelles des informations abondantes sont disponibles. Les résultats confirment que la CAA des groupes juvéniles (1-4 ans) dans la première décennie de la série historique (années 50) utilisée dans la dernière évaluation des stocks de thon rouge en 2014 est considérablement sous-estimée, de sorte que le nombre de juvéniles pour la période 1950-1962 utilisés dans l'évaluation représente la moitié des valeurs obtenues dans la présente étude pour la seule pêcherie du golfe de Gascogne au cours de la même période. Le scénario est encore pire si l'on considère que, selon une publication récente, environ 2,8 millions de spécimens d'un an devraient être ajoutés au chiffre présenté ici, lesquels sont absents de la CAA de la dernière évaluation des stocks, et ont été capturés à la senne dans les pêcheries marocaines de l'Atlantique entre 1958 et 1962.

RESUMEN

Basándose en datos analíticos previamente publicados, se presenta una revisión de la captura por edad (CAA) de la pesquería de atún rojo del golfo de Vizcaya entre 1950 y 2000. El periodo entre 1950 y 1965 tiene la menor información biométrica sobre la especie en esta zona y por ello se realizaron sustituciones utilizando los datos de años posteriores, para los que se dispone de abundante información. Los resultados confirman que la CAA de grupos juveniles (1-4 años) en la primera década de la serie histórica (años 50) utilizados en la última evaluación de stock de atún rojo de 2014 está considerablemente subestimada, de tal forma que el número de juveniles para el periodo 1950-1962 utilizado en la evaluación es la mitad de los valores obtenidos en este estudio solo para la pesquería del golfo de Vizcaya en el mismo periodo. El escenario es aún peor si consideramos que, de acuerdo con una publicación reciente, deberían añadirse aproximadamente 2,8 millones de ejemplares de un año a la cifra presentada en este estudio, que faltan de la CAA de la última evaluación de stock, capturados mediante cerco en las pesquerías marroquíes del Atlántico entre 1958 y 1962.

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KEYWORDS

Atlantic bluefin tuna, Bay of Biscay, catch at age statistics

Introduction

A recent publication on the bluefin tuna, *Thunnus thynnus* (L.), -ABFT- eastern Atlantic juvenile fisheries (Cort and Abaunza, 2015) reveals that the catches at age (CAA) of groups 1-4 during the first decade of the historical series (1950s) used in the last bluefin tuna stock assessment (ICCAT, 2014a) are substantially underestimated, a fact which undoubtedly creates an unreal vision of its fishing mortality (F 2-5) and of the recruitment in the first years of assessment. A summarized version of the publication (Cort and Abaunza, 2016) was presented at the data meeting of the ABFT Stock Assessment Group of the SCRS (ICCAT, 2016), in which this matter was discussed.

The review of the total catches (Task 1) of the Spanish Bay of Biscay fishery (between 1901 and 2000), which was presented to the SCRS in 2014 (Cort et al., 2015), has already been incorporated to the ICCAT database. The review provides details of catches/port of landing, as well as the catches corresponding to the fishery targeting this species and those that form part of non-targeted fishing in the albacore fishery -ALB-, *Thunnus alalunga* (Bonn.). This paper also contains the overall catches of the fishery, including the catches/year from France.

The present study follows the work plan aiming a full revision of the ABFT catch-at-size for the period 1950-2016 (Table 14; ICCAT, 2016), in our case of the Bay of Biscay fishery as a whole, i.e. including the data from France and Spain but using the final data referring to CAA.

1 Sources of information and methods

1.1 Data used to estimate CAA in the Bay of Biscay. Why CAA?

Le Gall (1950; 1951), Navaz (1950) and Bard et al. (1973) were the first authors to supply biometric data on ABFT in the Bay of Biscay; later, in the papers of Bard et al. (1978), Bard and Cort (1980) and Cort (1990), diverse analyses were presented using historical series of catches (from the 1960s) of the fisheries of the eastern stock using catch-at-size data previously converted to ages through the use of length frequencies and modal values, or age-length keys (ALKs) based on spine readings, a technique developed in the 1980s by Compeán-Jiménez and Bard (1983) which was later applied to Spanish ABFT fisheries by Rey and Cort (1984) and Cort (1990). In a more detailed analysis of the juvenile fisheries of the eastern Atlantic recently carried out using information going back to the beginning of the 1950s, Cort and Abaunza (2015; 2016) used a reviewed version of all the previous information using CAA data at all times.

For the elaboration of the demographic structure of the present study (1950-2000), four periods are considered:

1950-1965

Very few biometric data of Bay of Biscay ABFT from the 1950s are available, though the information contained in Le Gall (1950; 1951) is enough to know that, since the beginning of the studies of this fishery, this is fundamentally a juvenile fishery with a seasonal period of small spawners (ages 5+) in July and August, as Bard et al. (1973); Cort (1976; 1990) and Cort and Rodríguez-Marín (2009) described years later.

The ABFT length distributions published in Cort (1990) were based on the sales sheets from auctions at the Basque port of Ondarroa in 1953 and 1956. More recently, in the data review of the Bay of Biscay presented to the Data Recovery Plan of GBYP 02/2011 (Cort and Velasco, 2011), the length distributions for 1953 and 1956 from the same port are also available. The demographic structure of the present study for these two years is based, on one hand, on the catch of the port of Ondarroa (85 t in 1953; and 299 t in 1956, according to Cort et al., 2015), and on the other on the remaining catches, to which the percentage of catch at age of the period 1966-1986 has been applied (**Table 1**, taken from Cort, 1990), a period for which a lot of information is available. For the remaining years to 1965 this latter procedure has been followed. 312,415 ABFT samples were carried out between 1966 and 1986, the mean of which was 12.3 kg (Cort and Abaunza, 2015; 2016), and this is the value that has been applied to estimate the total number of fishes caught each year.

1966-1970

The catch-at-size (individual weight) of the ABFT corresponding to the Spanish fleet was obtained from the sales sheets of the port of Ondarroa. The first analytical assessment of the eastern stock in which catch-at-size converted to ages was published in Bard and Cort (1980). The sample size between 1966 and 1970 was 54,982 ABFT. These data were also presented to the GBYP Data Recovery Plan 02/2011. The age of each sampled individual was determined using Table 35 from Cort (1990), which permits the assignation of an age to each ABFT according to the corresponding month and weight for fishes of between 1 and 8 years.

The demographic structure of the French catches was determined by taking into account the proportion of ABFT of > 30 kg and of < 30 kg as published in Bard et al. (1978) and the values obtained for the Spanish fleet for ages 1-3 (< 30 kg) and 4-8 (> 30 kg).

1971-1974

It was at this time that the systematic collection of sales sheets separated by commercial categories began from auctions at the port of Hondarribia (Fuenterrabía). Using the tables available on page 231 of Cort (1990), age can be assigned according to commercial category. Moreover, from 1972 length sampling began at the port of St. Jean de Luz (Bard et al., 1973) and from 1974 at the port of Hondarribia (Cort and Cendrero, 1975).

1975-2000

A sampling network was set up in Spain with the systematic collection of sales sheets by commercial categories from auctions at the port of Hondarribia, length samplings and spine collection for age reading, the collection of logbooks from some vessels from the port of Hondarribia, and the systematic collection began of information on ABFT length samplings from the ports with fleets targeting ALB. From 1985 the age assignation of the samples was performed using annual *ALKs* created using fin spines readings (Cort, 1990). The CAA of the French catches was obtained from Spanish samplings taking into account the yearly proportion of fish > 30 kg and of < 30 kg.

Results

Table 1, which summarizes the catches (ages 1-4) in the Bay of Biscay in the period 1949-1962, corresponds to sampling carried out between 1966 and 1986. The juvenile catch in this fishery during the study period was 97.5% in number of fishes, age groups 1-3 being the most abundant. The mean weight of the catch throughout the period was 12.3 kg.

The actual ABFT catch in this fishery between 1966-1986 was 41,086 t, according to Cort et al. (2015) and the catch estimated using the mean weight/age was 40,852 t, just 0.6% lower, which goes to show how good the sample used was. After the present review the results remain the same.

Table 2 shows ABFT catches (t) by the targeting and non-targeting ABFT Spanish fleets in the Bay of Biscay (1950-2000). The last column refers to the total value of the catch (France+Spain) throughout the whole area.

Table 3 shows ABFT CAA in the Bay of Biscay (France+Spain) from 1950 to 2000. Of the total, ABFT juveniles (1-4 years) make up 97.7% of the catch in number of fishes, with age groups 1 and 2 the most numerous at 79.4% of the total number of ABFT caught. The mean weight of the catch in the period 1966-2000 was 13.3 ± 4.7 kg, a value that indicates that the mean weight used in estimates of the total catch between 1950 and 1965 (12.3 kg) is within the limits of that estimate. With the exception of 1999, year in which the fleet caught larger fishes (mean weight: 30.4 kg) due to an apparent scarcity of juveniles, or because fishermen moved by commercial interests headed their effort to the larger fish, in the remaining years the mean weight/year of the catch corresponded to specimens of 1-3 years old.

Figure 1 shows the overall catch of ABFT in the Bay of Biscay between 1950 and 2000. Two phases of maximum catches are seen: 1950-1959 and 1983-2000. The former coincides with the start of fishing with baitboat in the Bay of Biscay, and the latter with an increase in catches taken by the fleet targeting ALB, mainly vessels from the port of Guetaria in 1996 and 1997.

Discussion

The results of the present study confirm the conclusions of the article by Cort and Abaunza (2015; 2016), which concludes that the CAA of the juvenile groups of 1-4 years in the first decade of the historical series (1950s) used in the last bluefin tuna stock assessment (ICCAT, 2014a) are greatly underestimated. The number of ABFT juveniles (ages 1-4) for the period 1950-1962 used in that assessment was 1,860,188, whereas the values obtained in **Table 2** (present study), corresponding to ages 1-4 for the same time period, were 3,750,484 individuals. This means that twice as many juveniles were caught in the Bay of Biscay fishery alone than the total number used for the entire eastern stock in the stock assessment of 2014. As published in the article by Cort and Abaunza (2015), the juvenile catches by purse seine (PS) in Moroccan Atlantic waters from 1958 would need to be added, a number which, according to the above article, would be in the region of 2.8 million of age 1 fishes during the period 1958-1962. This would represent a total catch of 6.5 million juveniles between 1950-1962, a value 3.5 times higher than the figure of 1.9 million used in the 2014 stock assessment. The estimate of Moroccan catches made by Cort and Abaunza (2015; 2016) is based on ICCAT database (2014b) and papers by Fournestin and Dardignac (1962); Aloncle (1966); Dao and Bessineton (1974); Lamboeuf (1975); Brêthes (1978; 1979a, b); Brêthes and Mason (1979), which studied the Moroccan Atlantic ABFT fishery. It can be concluded from these studies that most of the catch taken by the purse seine fleet was made up of 1 year old fishes.

According to the analysis of the juvenile ABFT population made by Cort and Abaunza (2015; 2016) for the period 1949-1962, the massive catch of juveniles (ages 1-4) in the Atlantic fisheries of the eastern stock constituted a very considerable fishing mortality (F) with survival rates which, in the most optimistic scenario, were no greater than 16%. This would explain the reason underlying the drastic fall of the eastern Atlantic spawner fisheries from 1963, as occurred in the traps fishery of the strait of Gibraltar and northern European fisheries. These latter collapsed at the beginning of the 1980s and the traps thereafter had yields no more than a quarter of the levels that they obtained prior to the 1960s.

In accordance with all seen, it has not sense to keep the selectivity of the Bay of Biscay fishery in 5-6 years old for the period 1950-1960.

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Table 1. Summary of the demographic structure of ABFT catches in the Bay of Biscay between 1966 and 1986 (Cort, 1990). Actual catch (1966-1986): 41,083 t.

1966-1986									
Age	1	2	3	4	5	6	7	8	Total
N	1,194,522	1,428,008	480,409	144,345	50,689	18,379	8,531	4,293	3,329,176
%	35.9	42.9	14.4	4.3	1.5	0.6	0.3	0.1	100.0
Mean weight (kg)/age	5	10.5	19	37	55	73	94	113	
Inferred W (kg)	5,972,610	14,994,084	9,127,771	5,340,765	2,787,895	1,341,667	801,914	485,109	40,851,815
W (t)	5,973	14,994	9,128	5,341	2,788	1,342	802	485	40,852

Table 2. ABFT catches (t) by the targeting and non targeting ABFT Spanish fleets in the Bay of Biscay. Right column, total catch in all the area (taken from Cort *et al.*, 2015).

IEO and AZTI-Tecnalia				
Stock	ATE	ATE	ATE	ATE
Area	NE	NE	Bay of Biscay	Bay of Biscay
GearGrp	BB	BB	BB	BB
Year/Fleet	EU.ESP-ES-CANT_ABFT	EU.ESP-ES-CANT_ALB	TOTAL, Spain	Spain+France
1950	1,106	0	1,106	2,975
1951	979	0	979	3,872
1952	2,323	0	2,323	4,685
1953	1,771	0	1,771	4,135
1954	2,049	0	2,049	5,500
1955	3,528	0	3,528	6,559
1956	1,956	0	1,956	3,409
1957	2,467	0	2,467	4,017
1958	2,938	0	2,938	4,301
1959	1,769	0	1,769	3,800
1960	550	271	821	1,374
1961	514	176	690	1,597
1962	305	432	737	1,702
1963	520	318	838	1,381
1964	482	378	860	1,260
1965	582	584	1,166	1,787
1966	1,069	642	1,711	3,335
1967	543	368	911	1,771
1968	584	340	924	1,314
1969	901	325	1,226	1,760
1970	1,308	327	1,635	2,367
1971	1,450	125	1,575	2,255
1972	1,209	153	1,362	2,102
1973	1,471	399	1,870	2,421
1974	1,009	117	1,126	1,648
1975	945	275	1,220	1,912
1976	587	158	745	1,012
1977	1,035	164	1,199	1,791
1978	1,266	533	1,799	2,522
1979	1,000	173	1,173	1,448
1980	818	208	1,026	1,286
1981	428	357	785	938
1982	608	156	764	914
1983	1,114	1,245	2,359	2,759
1984	1,678	687	2,365	2,967
1985	1,488	360	1,848	2,338
1986	1,036	839	1,875	2,223
1987	1,202	311	1,513	2,046
1988	1,336	746	2,082	2,806
1989	1,399	714	2,113	2,573
1990	1,193	300	1,493	2,003
1991	938	203	1,141	1,706
1992	740	277	1,017	1,911
1993	3,219	321	3,540	4,639
1994	1,034	260	1,294	1,630
1995	2,397	375	2,772	3,497
1996	4,099	624	4,723	5,286
1997	5,139	921	6,060	6,329
1998	2,005	507	2,512	3,125
1999	1,112	82	1,194	1,782
2000	941	278	1,219	1,761
IEO's historic data (Cort, 1990), contrasted and				
complemented by AZTI-Tecnalia's data				
AZTI-Tecnalia's data complemented by IEO's data				

Table 3. ABFT CAA (number of fish, N) in the Bay of Biscay (France+Spain), 1950-2000.

Year	B of B (t) (Cort et al., 2015)	← AGE →								Total (N)
		1	2	3	4	5	6	7	≥ 8	
1950	2,975	86,837	103,769	34,832	10,401	3,628	1,451	726	242	241,886
1951	3,872	113,012	135,048	45,331	13,536	4,722	1,889	944	315	314,797
1952	4,685	136,746	163,410	54,851	16,379	5,714	2,285	1,143	381	380,909
1953	4,135	118,785	141,979	50,102	14,684	4,996	1,988	988	329	333,850
1954	5,500	160,536	191,838	64,393	19,229	6,708	2,683	1,342	447	447,176
1955	6,559	191,439	228,767	76,789	22,930	7,999	3,200	1,600	533	533,257
1956	3,409	80,614	96,333	32,336	14,548	8,688	2,982	982	450	236,933
1957	4,017	117,244	140,105	47,028	14,043	4,899	1,960	980	327	326,585
1958	4,301	125,533	150,010	50,353	15,036	5,245	2,098	1,049	350	349,675
1959	3,800	110,911	132,537	44,488	13,285	4,634	1,854	927	309	308,943
1960	1,374	40,103	47,922	16,086	4,803	1,676	670	335	112	111,707
1961	1,597	46,625	55,716	18,702	5,585	1,948	779	390	130	129,874
1962	1,702	49,676	59,362	19,926	5,950	2,076	830	415	138	138,374
1963	1,381	40,307	48,167	16,168	4,828	1,684	674	337	112	112,276
1964	1,260	36,776	43,946	14,751	4,405	1,537	615	307	102	102,439
1965	1,787	52,157	62,327	20,921	6,247	2,179	872	436	145	145,285
1966	3,335	9,357	88,389	88,157	19,190	772	298	0	16	206,179
1967	1,771	3,536	28,730	56,641	6,973	371	0	68	280	96,599
1968	1,314	10,463	25,083	15,880	15,543	2,294	24	14	32	69,333
1969	1,760	34,554	90,327	16,640	5,074	1,211	0	0	0	147,806
1970	2,367	44,272	97,729	24,620	7,274	3,695	1,501	742	0	179,834
1971	2,255	5,953	74,172	12,349	5,963	8,784	3,468	1,628	471	112,788
1972	2,102	17,500	58,080	21,606	2,828	6,802	3,151	1,728	1,035	112,730
1973	2,421	20,044	87,114	6,145	2,489	5,929	4,592	2,767	2,185	131,265
1974	1,648	17,513	67,129	28,786	3,380	1,948	542	278	92	119,668
1975	1,912	34,818	112,103	11,321	5,728	1,704	479	51	3	166,207
1976	1,012	1,237	56,327	12,880	2,323	1,398	408	134	19	74,726
1977	1,791	35,107	90,305	20,618	6,202	380	191	110	8	152,921
1978	2,522	165,820	66,970	9,813	14,252	3,736	380	49	34	261,054
1979	1,448	38,234	13,318	15,798	14,676	3,036	628	148	18	85,856
1980	1,286	41,962	32,255	10,649	3,908	3,116	1,218	472	29	93,609
1981	938	80,078	38,247	3,902	1,707	386	109	82	36	124,547
1982	914	23,728	33,033	9,389	3,249	871	367	0	0	70,637
1983	2,759	357,517	53,040	18,346	1,468	166	45	0	0	430,582
1984	2,967	56,331	147,317	40,968	5,144	1,180	222	97	35	251,294
1985	2,338	17,738	97,035	47,611	7,821	1,262	252	11	0	171,730
1986	2,223	219,519	57,236	7,942	8,390	835	200	26	1	294,149
1987	2,046	47,237	118,488	8,289	4,430	2,007	204	60	12	180,727
1988	2,806	320,484	74,779	11,699	2,552	963	505	99	23	411,104
1989	2,573	206,519	111,038	10,472	3,783	338	160	45	10	332,364
1990	2,003	127,827	48,222	23,799	7,806	1,632	350	11	1	209,648
1991	1,706	57,528	82,276	11,388	6,095	1,605	231	68	9	159,201
1992	1,911	62,860	103,356	19,488	2,150	940	54	64	0	188,912
1993	4,639	47,508	217,103	66,767	18,265	2,826	292	8	0	352,769
1994	1,630	37,981	37,289	26,749	13,403	774	15	6	2	116,218
1995	3,497	241,759	121,537	44,789	3,867	219	75	0	4	412,251
1996	5,286	250,437	120,627	62,698	31,436	7,408	58	4	6	472,676
1997	6,329	220,795	71,055	129,989	42,568	7,612	109	78	2	472,208
1998	3,125	59,534	61,412	19,013	39,580	4,504	415	509	274	185,241
1999	1,782	14,450	6,354	4,519	17,217	14,219	1,724	72	48	58,604
2000	1,761	65,240	26,492	9,446	5,488	6,502	5,737	172	23	119,100
Total	134,532	4,502,744	4,415,206	1,536,221	528,110	169,758	54,834	22,500	9,129	11,238,502

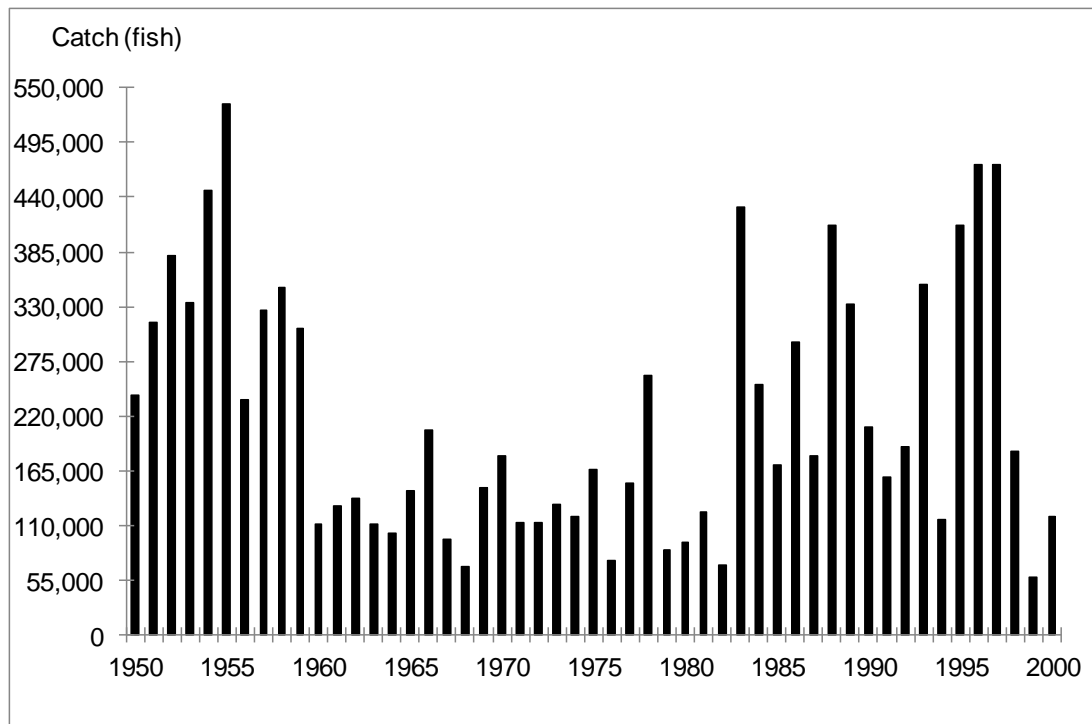


Figure 1. Catches of ABFT in the Bay of Biscay (1950-2000).